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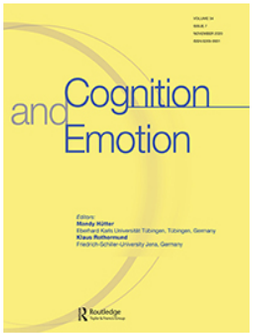

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Losses tune differently than gains: how gains and losses shape attentional scope and influence goal pursuit

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ABSTRACT

Research on the asymmetric effect of negative versus positive affective states (induced by gains or losses) on scope of attention, both at a perceptual and a conceptual level, is abundant. However, little is known about the moderating effect of anticipating gains or losses versus actually experiencing them and about any downstream consequences of these effects on goal-directed behaviour. In two studies, we show that gains versus losses induce qualitatively different processes. In Experiment 1, we demonstrate that the anticipation of monetary gains results in a narrowing of attentional scope, while experiencing gains broadens the scope of attention. We find the reverse pattern concerning monetary losses – while anticipation of monetary losses results in broadening of attentional scope, the actual experience of losses results in narrowing of attentional scope. Additionally, Experiment 2 replicates these findings and shows how differential attentional tuning as a function of the anticipation versus experience of gains versus losses modulates priming-induced goal-directed behaviour.

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Losses; gains; priming; attentional scope; attentional tuning

> The question is not what you look at, but what you see. (Henry David Thoreau ([Journal, 5 August 1851])

Do people process information differently depending on whether their current affective state is induced by gains or losses? Do they miss the forest for the trees as a function of feeling positive due to expecting or experiencing gains or, conversely, feeling negative when they anticipate or actually experience losses? As previous research shows, people can either attune to and process information at a fine-grained, restricted, detailed level or at a more global, broader level, both perceptually (Gable et al., 2015; Huntsinger & Huntsinger, 2013; Uddenberg et al., 2015) and conceptually (Fredrickson et al., 2005; Gable & Harmon-Jones, 2010c; Gable et al., 2015; Harmon-Jones et al., 2013; Kaplan et al., 2012). This narrowing versus broadening of attentional scope is known as "attentional tuning" (Harmon-Jones et al., 2011). Interestingly, research to date appears to be equivocal with regard to the influence of positive versus negative affective states on attentional scope. While some findings demonstrate broadening of attentional scope for positive affective states, such as amusement or happiness (Fredrickson et al., 2005; Rowe et al., 2007), other research shows that other such states could result in narrowing of attentional scope (e.g. desire, Levine et al., 2009). In a similar vein, some negative (hypervigilant) states, such as fear or anger, have been shown to narrow attentional scope (Dhinakaran et al., 2013; Gable et al., 2015; Hüttermann et al., 2015; Schmitz et al., 2009), while others, such as sadness, depression or anhedonia, may broaden attentional scope (Brailean et al., 2014; Gable & Harmon-Jones, 2010b; von Hecker et al., 2005). Still other findings point to inconsistent effects of affective states on attentional scope (e.g. Finucane et al., 2007; Huntsinger & Huntsinger, 2012; Huntsinger et al., 2010). These mixed findings may in part be attributable to the observation that examining the influence of

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discrete emotions on attentional scope can sometimes result in confounding their valence (positive vs. negative) with other properties, such as arousal, or with their motivational intensity, thus hampering straightforward inferences on the impact of positive versus negative states on attentional tuning (Harmon-Jones et al., 2013).

In the present paper, we aim to reconcile some of the conflicting findings by systematically dissociating positive versus negative affective valence from high versus low motivational intensity and by examining how these two factors might interact in affecting attentional scope. More specifically, our focus is on examining how attentional scope, both at a perceptual and a conceptual level (Posner & Presti, 1987), is modulated by people's anticipatory or actually experienced affective states resulting from either the anticipation or experience of monetary gains, or the anticipation or experience of monetary losses. Additionally, we show how attentional scope resulting from either anticipation or experience of monetary gains or losses impacts subsequent goal-directed behaviour as a function of responsiveness to primes delivered in locations converging with, or diverging from, one's currently maintained attentional scope.

This particular approach helps us to identify the distinctive additive and/or multiplicative (interactive) effects of affective valence and motivational intensity, through focusing on the effects of anticipatory versus experienced affective states on attentional scope not only for positive affective states as previously demonstrated (Gable & Harmon-Jones, 2010a, 2011; see also Nadig et al., 2019), but also for negative affective states. Moreover, this approach may aid in understanding the downstream consequences of gains versus losses on induced attentional scopes for motivated behaviour.

Gains, losses and attentional scope

While the literature posits that affective states, the motivational underpinnings of these affective states and concomitant attentional processes are all interrelated, there is a clear lack of consensus with regard to the underlying mechanism driving the phenomenon of attentional tuning. The conventional account, proposed by Gasper et al. (2002; see also Friedman et al., 2010), suggests that affective valence is a critical precursor to narrowing versus broadening of attentional scope, such that positive affective valence broadens and negative affective valence narrows such scope. Indeed, research has shown, for example, that people experiencing positive affective states, such as happiness or amusement, exhibit a broadening of scope (Fredrickson et al., 2005). More specifically, the broaden-and-build framework of positive emotions (Fredrickson et al., 2005) suggests that such positive affective states broaden scope, thereby allowing individuals to pursue a wider range of actions and possibilities that might enable them to explore and identify new and additional resources and opportunities. In contrast, various negative affective states, such as anger, fear or disgust, have been found to induce a more narrowed scope, prompting the individual to respond to environmental threats with acute, task-specific actions (e.g. to flee or attack; Gable & Harmon-Jones, 2010b; Fredrickson et al., 2005). Yet, as alluded to above, the findings so far have been mixed. In addition to inconclusive results (Finucane et al., 2007; Huntsinger & Huntsinger, 2012; Huntsinger et al., 2010), further research has indicated that some positive affective states can narrow attentional scope, while some negative affective states can broaden it. Rather than helping the individual identify rewarding new opportunities, it has been suggested that such broadening of scope under the conditions of negative affect may aid the individual in understanding why previous actions might have been unsuccessful and exploring more fruitful future options (see Harmon-Jones et al., 2013 for an overview).

As a consequence of this equivocal "state of the science", the "traditional" perspective of valence-affecting-scope has recently been challenged by Gable, Harmon-Jones and colleagues (Gable & Harmon-Jones, 2010a; Gable et al., 2008; Harmon-Jones et al., 2011). They propose that many previous studies have examined discrete emotions that have confounded affective valence with motivational *intensity* (i.e. the urge to move toward/away from a stimulus) and they argue that the latter rather than the former is the critical factor underlying attentional tuning. In particular, Gable and Harmon-Jones (2010a, 2011) investigated the influence of the motivational intensity of particular positive affective states, such as monetary gains, on attentional scope, while keeping affective valence constant. They demonstrated that states of higher motivational intensity, i.e. when people *anticipate* monetary rewards, produce a more narrowed attentional scope compared to states of lower motivational

intensity, i.e. when people actually *experience* such monetary rewards. Hence, this particular stream of investigation suggests that it is the *urge* or *desire* for the gain rather than the actual *experience* of the gain that induces (constricted) attentional tuning rather than the affective valence per se. The rationale behind this phenomenon suggests that the increased motivational intensity as a function of anticipation of gain narrows the attentional scope to aid in task-specific reward acquisition. This narrowing of attentional scope occurs at both a perceptual and a conceptual level – people not only focus predominantly on central rather than peripheral cues in the visual field, but they also form a narrower, more restricted range of associations in their long-term memory (Anderson et al., 1994; Gable et al., 2011). The reduced motivational intensity experienced after a reward has been successfully attained, in contrast, promotes a broadening of attentional scope, both at the perceptual and the conceptual level. Broadening of attentional scope involves a shift from a restricted focus on the centre of sensory perception to include peripheral stimuli and it is thought to assist people in the search for new opportunities present in the environment (Fredrickson et al., 2005; Harmon-Jones et al., 2011).

Since affective valence and motivational intensity are conceptually distinct constructs, which frequently become confounded when studying discrete emotions, the question becomes imperative as to whether these two factors are independent or interdependent when it comes to their impact on attentional scope and thus whether they exert additive or multiplicative (interactive) effects. While studies on the motivational intensity constitute an important step forward, it is striking to note that to date there is still no work that has systematically varied both affective valence (positive vs. negative) and motivational intensity (low vs. high) simultaneously, examining their additive and interactive effects on attentional tuning: a void the present research aims to fill.

Indeed, the previous work that addressed the role of motivational intensity has been largely confined to addressing differences in motivational intensity within the spectrum of *positively* valenced affective states, while research on negative states has focused on discrete emotions, which vary according to many more dimensions than simply their intensity (e.g. sadness vs. disgust, Gable & Harmon-Jones, 2010a). Hence, it is unclear if, and to what extent, similar processes may occur for *negatively* valenced affective states which vary in nothing more than their motivational intensity. At first glance, the answer to this question may seem to be a straightforward affirmative; however, different streams of literature actually suggest qualitatively different processes, thus indicating diverging expectations for positive versus negative affective states. Hence, exploring this question can have important repercussions for our understanding of positive versus negative affective states of differing motivational intensity and their respective impact on attentional scope and its downstream consequences. By replicating and extending past research (Gable & Harmon Jones, 2010a), we will zoom in on positive versus negative affective valence through contrasting (monetary) gains with losses. Additionally, we will concentrate on different levels of motivational intensity by contrasting the anticipation of these gains and losses with the actual experience of them.

How affective valence and motivational intensity may interact

There are various reasons to assume that the effects of anticipation versus experience affective states on attentional scope may not be symmetrical for gains versus losses. First, the phenomenon of loss aversion – the idea that "losses loom larger than gains" – already suggests such asymmetry (Kahneman et al., 1979). While previous research has shown that the anticipation of gains narrows attentional scope compared to the experience of gains (Gable & Harmon Jones, 2010a), the literature does not appear unequivocal on whether the anticipation or experience of losses may produce similar effects on attentional scope (Dhinakaran et al., 2013; Sugimoto et al., 2007). At least two contrasting perspectives may be put forward: one that suggests a difference in the *strength* of the effect of motivational state (anticipation vs. experience) as a function of gains versus losses, and another that points to differences in the *direction* of the effect.

With regard to the first perspective, research on the impact bias (the misprediction of the duration and intensity of an affectively valenced experience, Buehler et al., 2001; Gilbert et al., 2002; Wilson & Gilbert, 2003; Wilson et al., 2000) would lead to the expectation of an ordinal interaction between motivational state (anticipation vs. experience) and type of outcome (gains vs. losses) on attentional scope, with more pronounced effects expected for motivational state under conditions of losses compared to gains.

More specifically, the tendency of people to overestimate the anticipated impact of various life events (Schkade et al., 1998), particularly for negative states (the negativity bias, Baumeister et al., 2001; Ito et al., 1998; Rozin et al., 2001; Vaish et al., 2008) would imply that the motivational intensity of anticipating losses would be particularly large and possibly larger than the motivational intensity of anticipating gains. Thus, attentional scope in states of anticipation may narrow more for losses than for gains. Furthermore, the stronger tendency to overestimate the anticipated impact of a negative event than a positive one also implies that once a loss is actually experienced, the experience itself has a higher likelihood to be *less* intense than what was anticipated, which may produce feelings of relaxation and relief (Levine et al., 2009). If this is true, then the postulated motivational intensity of experiencing losses may be even less than the motivational intensity of experiencing gains, implying that loss experience states may yield broader attentional scopes than gain experience states. In sum, these notions would imply that the motivational intensity of anticipation would be stronger, that the motivational intensity of experience would be weaker for losses than for gains, and that the impact of motivational state (anticipation vs. experience) on attentional scope would therefore be more pronounced for losses than for gains.

But this predicted ordinal interaction constitutes only one possibility. A second, rival perspective could also be proposed – one that would actually lead to opposite predictions about the impact of motivational state (anticipation vs. experience) for gains versus losses. This perspective takes the previously validated assumptions underlying the motivational intensity of anticipating versus experiencing gains as a baseline (Gable & Harmon Jones, 2010a), but challenges the previous assumptions underlying the motivational intensity of anticipating versus experiencing losses and suggests a reverse pattern. Several traces of evidence actually seem to point in that direction. First, with regard to the anticipation of losses, there are reasons to assume that its concomitant motivational intensity may be less pronounced than the previous account would predict.

More precisely, work on overoptimism and wishful thinking (Krizan et al., 2009) demonstrates that people are sometimes prone to *underestimate* the likelihood of future undesirable outcomes (see Van Dijk et al., 2003; Vosgerau, 2010). If so, this may lead to *lower* rather than higher motivational intensity for anticipating future losses. Thus, following this reasoning, attentional scope in the anticipation states may actually broaden for losses, which might help the individual monitor the environment for other sources of reward. Conversely, such wishful thinking may actually amplify the "pain of losing" once it is actually experienced, so experiencing losses may induce *higher,* not lower, motivational intensity than anticipating losses, which implies that loss experience states would yield narrower attentional scopes than loss anticipation states. Compatible with this notion, the related work does indeed suggest that actually experiencing losses rather than merely anticipating them engenders increased and intense levels of frustration and arousal (Angus et al., 2019; Vaish et al., 2008; Yechiam et al., 2013). Strikingly, additional studies suggest that the intensity of experienced losses remains invariably high over a sequence of consecutive losses, suggesting that experiencing multiple losses does not lead to habituation (Breiter et al., 2001; Kringelbach et al., 2004). Moreover, the basic notion of loss aversion (Kahneman et al., 1979), and much of the work on its ensuing consequence of risk seeking, also points to the possibility that within the loss domain, it is not the mere anticipation, but the actual experience of losses that "hits harder". For example, Andrade et al. (2009) have demonstrated that the typical response to the actual experience rather than anticipation of losses is qualitatively different to the response following the experience rather than anticipation of gains. Their research focused on sequential gambling following an outcome planning (anticipation) and experience state. They demonstrated that while the anticipation versus the experience of gains did not affect people's gambling strategies, it proved consequential for losses. More specifically, after experiencing rather than merely anticipating losses people's gambling strategies became markedly riskier. Thus, it is well conceivable that the motivational intensity of *experiencing* losses is higher than the motivational intensity of merely anticipating them. If so, then our previously presented reasoning may actually be turned on its head and yield the opposite expectation. Hence, in contrast to gains, it may well be that in the loss domain, it is not the *anticipation* but rather the actual *experience* of a loss that may trigger the narrower scope of attention (see Table 1).

Thus, this perspective would hold that, in line with Gable et al. (2011), for gains one would expect anticipation to yield increased narrowing in attentional

Table 1. Summary of hypotheses regarding the influence of monetary gains versus losses on attentional scope.

	Motivational state	
Earning potential	*Anticipation*	*Attainment*
Proposition 1		
Gain	Narrow	Broad
Loss	Narrower	Broader
Proposition 2		
Gain	Narrow	Broad
Loss	Broad	Narrow

Note: The table summarises expectations of the influence of both earning potential (gain vs. loss) and motivational state (anticipation vs. experience) on attentional scope.

scope compared to actual experience. For losses, in contrast, one would now expect that actual experience would yield increased narrowing in attentional scope compared to mere anticipation. In sum, these predictions would imply observing not an ordinal, but a *disordinal*, crossover interaction in which the direction rather than the strength of the effect of motivational state (anticipation versus experience) on attentional scope would be modulated as a function of the type of outcome (gains versus losses).

To recapitulate, in the present work, we aim to reconcile some of the conflicting findings by systematically dissociating positive versus negative affective valence from high versus low motivational intensity and by examining how the two factors might interact in affecting attentional scope. More specifically, we will explore two competing hypotheses regarding the differential influence of anticipating versus experiencing monetary gains or losses on attentional scope and its downstream consequences for goal-directed behaviour. When following research on the impact bias (Wilson et al., 2000), the pattern of anticipating versus experiencing losses should be comparable to that observed for gains, only "steeper", as in more pronounced. Hence, from that perspective, and in line with Gable and Harmon-Jones' (2011) findings for gains, the anticipation of losses should similarly induce a narrower scope of attention than the experience of losses and the difference between anticipation and experience of losses should be larger than for gains.

The alternative perspective, rooted in work on overoptimism, wishful thinking and the recent work on the behavioural and attentional consequences of experiencing losses (Andrade et al., 2009; Angus et al., 2019; Yechiam et al., 2013) would yield the expectation that compared to gains, the pattern for losses would reverse, i.e. result in a narrower attentional scope, when people experience rather than anticipate losses.

Additionally, we will examine any downstream consequences of attentional scope resulting from either the anticipation or experience of monetary gains or losses. Given that narrowed attentional scope is associated with increased motivational intensity, it makes sense to expect that such a narrowed scope may impact subsequent goal-directed judgment and decision-making and that it will do so as a function of the extent to which one is exposed to goal-relevant stimuli (primes) delivered in locations converging with, or diverging from, one's currently maintained attentional scope. Building on the findings demonstrating that centre-focused attention focused affects decision-making to the largest extent (Atalay et al., 2012; Tatler & Tatler, 2007), we expect that particularly centrally located primes will unobtrusively shape subsequent attitudes and behaviours, but only if they are attended to, thus when the attentional scope is narrow.

The present research

We test our hypotheses in two lab experiments, investigating how the anticipation versus experience of monetary gains or losses modulates attentional scope, both at a perceptual and conceptual level. Experiment 1 begins with testing our expectations particularly for perceptual attention. For our work, we adapted and extended a variation of the so called Monetary Incentive Delay (MID) task (Knutson et al., 2000, 2001) developed by Gable and Harmon-Jones (2010a, 2011; see also Nadig et al., 2019). In this paradigm, participants either anticipate or actually attain a monetary reward as a function of task performance using multiple trials. As part of the task, and per trial, attentional scope is measured, for example using a Navon task (Gable & Harmon-Jones, 2010a, 2011; Nadig et al., 2019). The size of the reward is constant across conditions, only the anticipation/attainment of it varies. Hence, the task keeps the valence of the (positive) affective state constant (since it always involves the same monetary reward), but varies the motivational intensity (since the motivational intensity of anticipating the reward is larger than of attaining it). Extending this paradigm, we not only varied the anticipation/experience of monetary rewards, but also of monetary losses, and we gauged attentional scope using reaction times during a Navon task (Navon & Navon, 1977) to

measure attentional scope at the perceptual level (Förster et al., 2006; Friedman et al., 2010; Gable & Harmon-Jones, 2010a, 2011; Hicks et al., 2012). In this way, we are able to specifically pinpoint whether people process visual information in a fine-grained manner, while attending to a limited scope of information, or whether they become attentive to a greater range of environmental stimuli as their attentional scope broadens. Moreover, following closely the established by Gable and Harmon-Jones (2010a, 2011) experimental paradigm allows us to disentangle the impact of affective valence on attentional scope from the influence of motivational intensity.

The second experiment bridges the perceptual and the conceptual levels of attentional scope by examining how attentional tuning guides consecutive goal pursuit and governs responsiveness to goal-relevant priming procedures. To this end, we examine the effectiveness of goal-relevant primes (Karremans et al., 2006; Strahan et al., 2002) delivered either in the central or peripheral scope of vision. In Experiment 2, we not only replicate the findings from the first experiment, but we also extend these findings to downstream consequences for motivated (goal-directed) judgment and decision-making.

Experiment 1

Method

Participants and design

For the first experiment, we recruited 123 students (M_{age} = 21.42, SD = 2.82; 56 females, 67 males) to participate in a lab study that was said to test their performance in a game during which they needed to conduct the flankers task (Eriksen et al., 1974) – indicating the direction of a middle arrow within an array of arrows. Three participants did not provide any correct responses to the local target letters during our attentional task (Navon task; Navon & Navon, 1977), therefore, we ended up with 120 usable responses. Participants were randomly assigned to conditions in a 2 (motivational state: anticipation vs. experience state) × 2 (monetary outcome: gains vs. losses) between-subjects design with the breadth of attentional scope as the main dependent variable. Participants obtained money or research credits for participation and they were informed that there was a possibility to earn extra money (max. €4.80) during the study based on their performance in the game. A sensitivity analysis using G*Power to detect the focal interaction (using a multiple regression model assessing R^2 increase with three predictors) showed that the sample yielded 80% power to detect a small to medium effect (f = .25). Given that this detectable effect is close to the typical effect size in (social) psychology (f = .21; Richard et al., 2003) and falls within the range of effect sizes (f = .25 and f = .73) of the two-way interaction terms reported previously by Gable et al. (2011) in their studies exploring the impact of affective states of varying motivational intensity on attentional scope by implementing a similar experimental procedure, we conclude that the sample size offers an acceptable level of power to detect the tested effects.

Procedure

Participants were randomly assigned to participate in two types of games – either in a "win" game (gain condition) or a "loss" game (loss condition) in which their flankers performance would determine their outcomes. Each game consisted of two types of trials: non-neutral and neutral. In each non-neutral trial in the "gain" condition, participants had the opportunity to win an additional €0.10, up to a total of €4.80, depending on their flankers performance until the end of the study. Conversely, participants assigned to the loss condition started with €4.80 at the beginning of the experiment and they were informed that they needed to do their best in the flankers task to keep as much money as possible until the end of the study. In each non-neutral trial, participants assigned to the loss condition could lose an additional €0.10. In the neutral trials, performance in the flankers task did not determine any additional gains or losses. The order of the trials was randomised across participants.

In accordance with previous manipulations of anticipation and experience states (Gable et al., 2011), we induced both anticipation and experience states by altering the order of the tasks that participants were carrying out in each of the 48 trials of the game. Each trial consisted of the following fixed elements:

A. Expectancy cue: at the beginning of each trial, participants were instructed and exposed to one of two possible symbols: a neutral symbol (i.e. a spades symbol) indicating that in the coming trial no monetary gains or losses should be expected; or a non-neutral symbol

representing the possibility of winning or losing money (depending on the condition) in the upcoming trial (i.e. a clubs symbol);

B. Navon task (Navon & Navon, 1977): the focal task for measuring our dependent variable (see below for details). In each trial, participants saw a large letter composed of smaller letters (e.g. a large A composed of small Xs) and were asked to identify, in a randomised order and as quickly as possible, either the large letter (global target letter; responses collected for 24 trials) or the small letter (local target letter; responses collected for 24 trials) by pressing an assigned key on the keyboard. We collected reaction times in each trial of the game that, in line with previous research (Gable et al., 2011), were subsequently used to assess the breadth of attentional scope. This task was presented as unrelated to the flankers task game, in which participants were trying to either win additional money or prevent any additional monetary losses, but they were informed that they should perform it as quickly and accurately as possible.
C. Flankers task (Eriksen et al., 1974): As stated, participants were made to believe that their final pay-offs (as a function of the gain or loss condition they were in) would depend on their performance during this specific task. In order to earn additional money or prevent possible losses, participants were instructed to indicate the direction of a middle arrow presented in an array of arrows by pressing the assigned keys as quickly and accurately as possible;
D. Obtaining feedback about the outcome of the trial: in each trial, participants received information on the screen about any changes in their total monetary gains.

Participants assigned to the anticipation condition completed the Navon task after they saw an expectancy cue, but before they engaged in the goal-relevant flankers task allowing for additional monetary gains and before they received feedback about any potential gains or losses. Participants in the experience condition first conducted the flankers task after they saw the expectancy cue and obtained feedback about their monetary gains or losses, and only then did they perform the Navon task (Gable & Harmon-Jones, 2010a, 2011). The specific order of tasks conducted across conditions can be seen in Figure 1 (Panel A: Anticipation States, Panel B: Experience States).

In order to enhance the realism of the game and avoid unwanted habituation responses, 8 of the 24 trials disconfirmed the initial expectation evoked by the expectancy cue (see Knutson et al., 2000, e.g. participants had a chance to win extra money but ultimately did not win it). Thus, 8 out of 24 potentially winning versus potentially losing trials yielded no additional monetary gains or losses when these were expected to occur. In order to keep the affective valence constant across conditions, and due to their expectancy-disconfirming nature, these 8 trials were not included in the analysis. Moreover, the 24 neutral trials were also excluded from the analysis, as participants did not experience any gains or losses resulting from their performance in these particular trials. Specific trials were assigned beforehand as gain or loss trials in which participants would either win or lose irrespective of their reaction times. Nevertheless, accuracy was always of primary relevance – providing a wrong answer in the flankers task in non-neutral trials never led to monetary gains in the "gain" condition and resulted in additional losses in the "loss" condition.

Dependent measure

In our analysis, we focused on response times (RTs) to the local letters as the key target due to the fact that global attentional scope is the default attentional mode (Huntsinger & Huntsinger, 2012; Kimchi & Kimchi, 1992; Kimchi et al., 1982; see Table 2 for the summary of means and standard deviations per condition). The "global precedence" effect (Derryberry & Reed, 1997; Navon & Navon, 1977) shows that attentional processes are temporally organised and the default mode with which new information is approached is the global attentional scope, which might be further modulated by affective states (Fredrickson et al., 2005; Gasper et al., 2002; Schnall et al., 2008), motivational states (Gable & Harmon-Jones, 2010a, 2011) or environmental cues (Friedman et al., 2010). Furthermore, innate variability in processing global information has been observed among individuals (Zmigrod et al., 2015). As default global processing mode may obscure meaningful variance in attentional scope that could be witnessed as a result of anticipation or experience states of gains versus losses, we therefore account for this baseline processing mode while focusing predominantly on 8 trials with local letters as key target responses, controlling at the same time for 8 remaining trials in which the global letters were the response target. Following

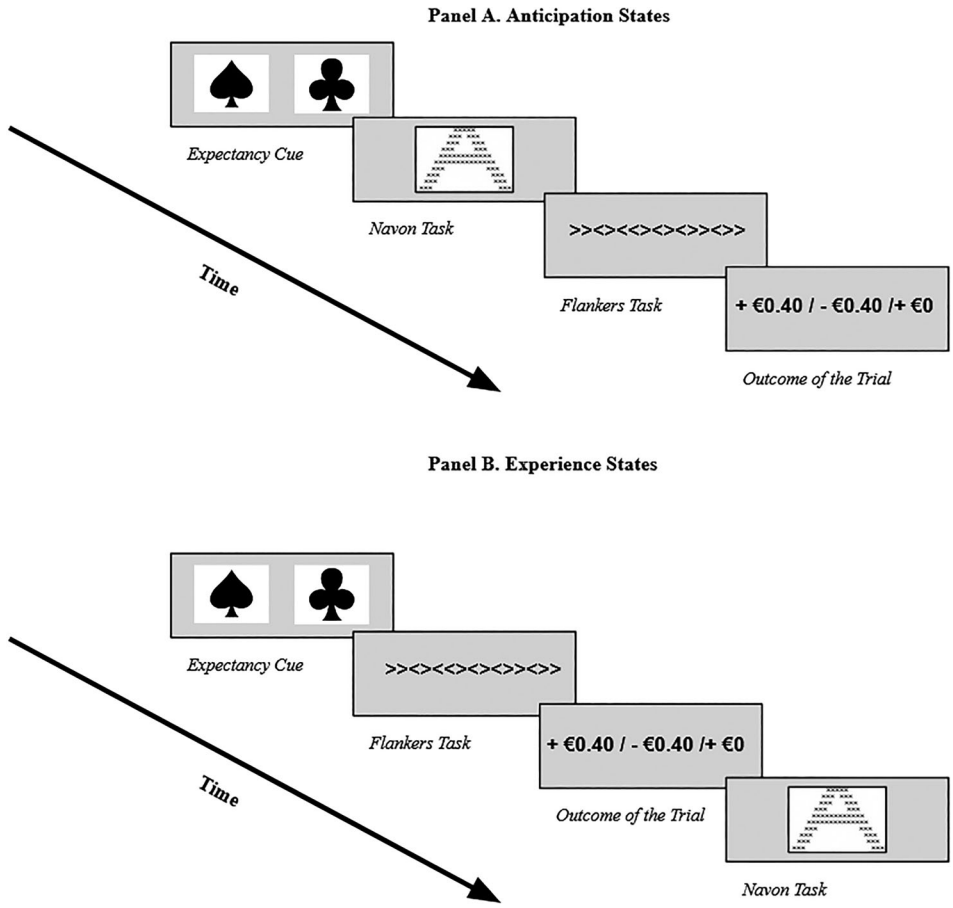

Figure 1. Order of tasks conducted in Experiment 1 for anticipation states (Panel A) and experience states (Panel B).

Wang et al. (2017), the inclusion of this covariate in our analysis is further warranted as it substantially boosts statistical power while having only a negligible impact on the probability of Type I error.

Results

To test our interaction between gains versus losses and anticipation versus experience states, we conducted a 2 (monetary outcome: gains vs. losses) × 2 (motivational state: anticipation vs. experience state) analysis of variance of mean reaction times to local target letters (8 trials), while controlling for reaction times to global target letters (8 trials). Only a significant cross-over interaction between anticipation/experience states and gains/losses emerged ($F(1, 115) = 4.15$, p=.04, $\eta^2 = .04$; see Figure 2). More specifically, and replicating previous research (Gable & Harmon-Jones, 2010a, 2011), participants in the gain anticipation state responded faster to the local target letter (M = 1177.81 ms, SD = 192.68 ms) than participants in the gain experience state (M = 1250.97 ms, SD = 248.92 ms). Interestingly, in the loss conditions, this pattern was found to be reversed, i.e. participants provided quicker responses to the local target letter when they had already experienced a loss (M = 1182.64 ms, SD = 361.44 ms), as opposed to participants who were anticipating a possible monetary loss (M = 1248.20 ms, SD = 559.37 ms; see Figure 2).

Neither of the simple main effects of anticipation versus experience state within the gain/loss conditions turned out to be significant (for losses: $F(1,$

Table 2. Summary of Means and Standard Deviations per condition in Experiment 1.

	Motivational State	
Earning potential	*Anticipation* *M*	*Experience* *M*
Gain	1.10 (0.19)	1.23 (0.25)
Loss	1.28 (0.56)	1.25 (0.36)

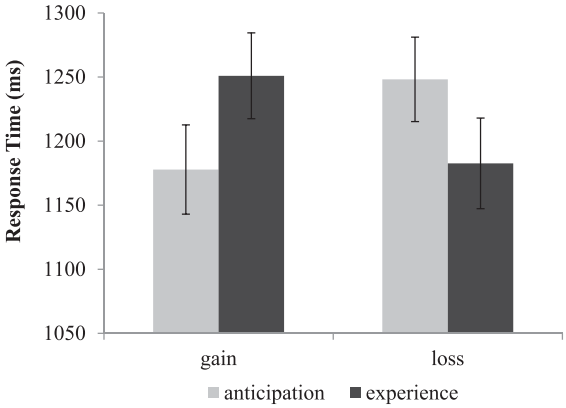

Figure 2. Mean reaction times (in milliseconds, ms) to local target letters during Navon task over 8 trials, using mean reaction times to global target letters as a covariate (8 trials). Error bars denote one standard error around the mean.

115) = 1.85, p = .18; for gains: $F(1,115)$ = 2.31, p = .13; for anticipation states: $F(1, 115)$ = 2.15, p = .15; for experience states: $F(1, 115)$ = 1.96, p = .16). Thus, the interaction is driven by the difference in *direction* of the simple effects rather than their respective *strengths* supporting the inference of a disordinal rather than ordinal interaction.

Discussion

The results of Experiment 1 replicate previous research in demonstrating that attentional scope narrows for the positive affective states of high motivational intensity, i.e. for the anticipation of monetary gains (Gable & Harmon-Jones, 2010a, 2011). Moreover, we contribute to previous research by providing support for our alternative expectations regarding the attentional tuning induced by the anticipation versus the experience of losses. When it comes to monetary losses, we observe narrower attention when one actually experiences rather than merely anticipates losses.

In our second experiment, we extend these findings by examining the impact of gain- versus loss-induced attentional scope for subsequent goal pursuit.

Experiment 2

Our second experiment builds on Experiment 1 while not only replicating, but also extending our findings. We expand our investigation to the domain of conceptual attentional scope, exploring alongside the effects of affective and motivational states on perceptual attention their interactive effects on the scope of conceptual attention. We employ priming procedures (i.e. unconscious effects of memory whereby identification, production or usage of an item is improved by an earlier encounter; Levy et al., 2004) as their effectiveness depends on the scope of both conceptual and perceptual attention (Spruyt et al., 2009). For this experiment, we selected thrift primes (e.g. sales, promotions, Chartrand et al., 2008) that are goal-relevant for the motivational states (anticipation vs. experience) accompanying the affective states induced by monetary gains or monetary losses.

Research to date has demonstrated that the goal-relevance of primes is a crucial factor influencing their effectiveness (Karremans et al., 2006). Nonetheless, in accordance with our theorising, not only goal-relevance, but also the specific location of the prime should determine whether primes become effective or not. Due to the fact that attention focused on the visual centre has been demonstrated to have the greatest impact on decision-making (Atalay et al., 2012; Chandon et al., 2009; Tatler & Tatler, 2007), we expect that central rather than peripheral primes will exert the strongest influence on decision-making in states of high motivational intensity.

In line with the findings from Experiment 1, we posit greater receptivity to centrally delivered goal-relevant primes for monetary gains when the gains are *anticipated* rather than experienced, i.e. under the conditions of narrowed attentional scope. In contrast, building on the findings of Experiment 1, we expect this pattern to reverse for monetary losses: due to increased narrowing of attentional scope under conditions of experiencing rather than anticipating losses we predict to observe higher susceptibility to centrally-delivered goal-relevant primes particularly in the loss experience rather than the loss anticipation state.

Based on previous research (Chartrand et al., 2008), we investigated in which circumstances exposure to thrift primes (words such as sales, promotion) would affect the subsequent pursuit of thrift goals (the goal of saving money). In line with prior studies demonstrating that exposure to thrift primes increases preference for cheaper products (Chartrand et al., 2008), we assessed the effectiveness of thrift primes by measuring willingness-to-pay for a set of daily-used products (in Euros; Ariely et al., 2003; Festjens et al., 2014). Willingness-to-pay is not a direct measure of behaviour, but a behavioural intention measure (Ajzen et al., 1992). As goal pursuit is defined as a motivated behaviour to attain desired end states (Dik et al., 2007),

which is prompted by behavioural intentions (Ajzen & Ajzen, 1991), willingness-to-pay can be considered an appropriate measure to capture the impact of exposure to thrift primes on subsequent goal pursuit (Chartrand et al., 2008). Indeed, it has been widely used in previous research to tap into the impact of experimental manipulations on the pursuit of such goals as reward-seeking (Festjens et al., 2014), maintenance of social status (Pettit et al., 2010) or restoration of self-image (Sivanathan et al., 2010).

Method

Participants and design

We submitted effect sizes based on a recent meta-analysis investigating the behavioural effect of incidentally-presented words ($f = .18$; Weingarten et al., 2016) to an *a priori* power analysis (Faul et al., 2009), setting power to 0.80 at $\alpha = 0.05$. As a result, we obtained a minimum required sample size of 256 participants for the target 3-way interaction (see next). We used this as a minimum and decided to continue data collection for as long as the allotted lab time and resources would allow us, ultimately yielding a total of 567 participants (M_{age} = 21.25, SD = 3.05; 251 males, 316 females) during two independent data collection moments. The lab experiment was advertised as two unrelated studies about games and memory. Participants received money or research credits for participation. Additionally, they were informed that there was a possibility to earn extra money (max. €4) during the study. Participants were randomly assigned to conditions in a 2 (monetary outcome: gains vs. losses) × 2 (motivational state: anticipation vs. experience state) × 2 (location of the prime: central vs. peripheral) between-subjects design with the willingness-to-pay (in Euro) for a set of daily-used products as the main dependent variable.

Procedure

Participants completed the experiment on a 19-inch computer screen. The experiment consisted of two main parts: the memory task (during which participants were primed) and the game that allowed us to assign participants to either gain or loss conditions. In line with the previous study, for the games part of the study, participants were asked to play a game during which they were asked to do their best to either win (gain) or keep (loss) a certain amount of money. Participants assigned to the gain anticipation versus experience condition were told that they would be able to earn extra money, up to a maximum of €4.00. In contrast, participants assigned to the loss conditions learned that they would start the game with €4.00 and could lose an additional €0.40 in each trial. Participants played 10 rounds of the flankers task (Eriksen et al., 1974; see experiment 1 for details) and were asked to respond as quickly yet accurately as possible in order to beat the average reaction times obtained during the same task by students from their university during a pretest (Gable & Harmon-Jones, 2010a, 2011).

Similarly to experiment 1, the order of the tasks differed across conditions. Participants assigned to the *experience* conditions first completed 10 rounds of the flankers task, were then informed about their performance in the set of 10 flankers tasks and only later were they primed during an ostensible memory task. For the participants assigned to the *anticipation* conditions, the order of these tasks was reversed and the memory task preceded the set of 10 flankers tasks (see Figure 3 for specific order of tasks, Panel A: Anticipation States, Panel B: Experience States).

During the ostensible memory task, aimed at priming participants with thrift-related concepts, participants were exposed to 24 words. These words were flashed for a brief moment (0.5 s) on the screen. We varied the location of the words as a between-subjects factor. For half of the participants, words were presented in the central scope of vision (i.e. centre of the screen); for the remaining ones, words were presented in the peripheral scope of vision (thus in each of the four corners of the screen). The order of words was randomised across participants. The six words (promotion, sale, discount, bargain, reduction, deal; Chartrand et al., 2008) that were shown during the memory task were the goal-relevant primes. The 18 remaining words were neutral words selected from the Affective Norms of English Words (ANEW; Bradley & Lang, 1999; e.g. bench, procedure, pollen, oil, etc.).

In reality, gains or losses were not determined by the participants' performance – certain trials were programmed as winning or losing trials in order to keep the total monetary compensation stable across the conditions. As a result, each participant left the lab with an additional pay-off of €2. The sequence of trials was randomised across participants. Funnelled debriefing indicated that participants were not suspicious about our manipulations related to gains versus losses.

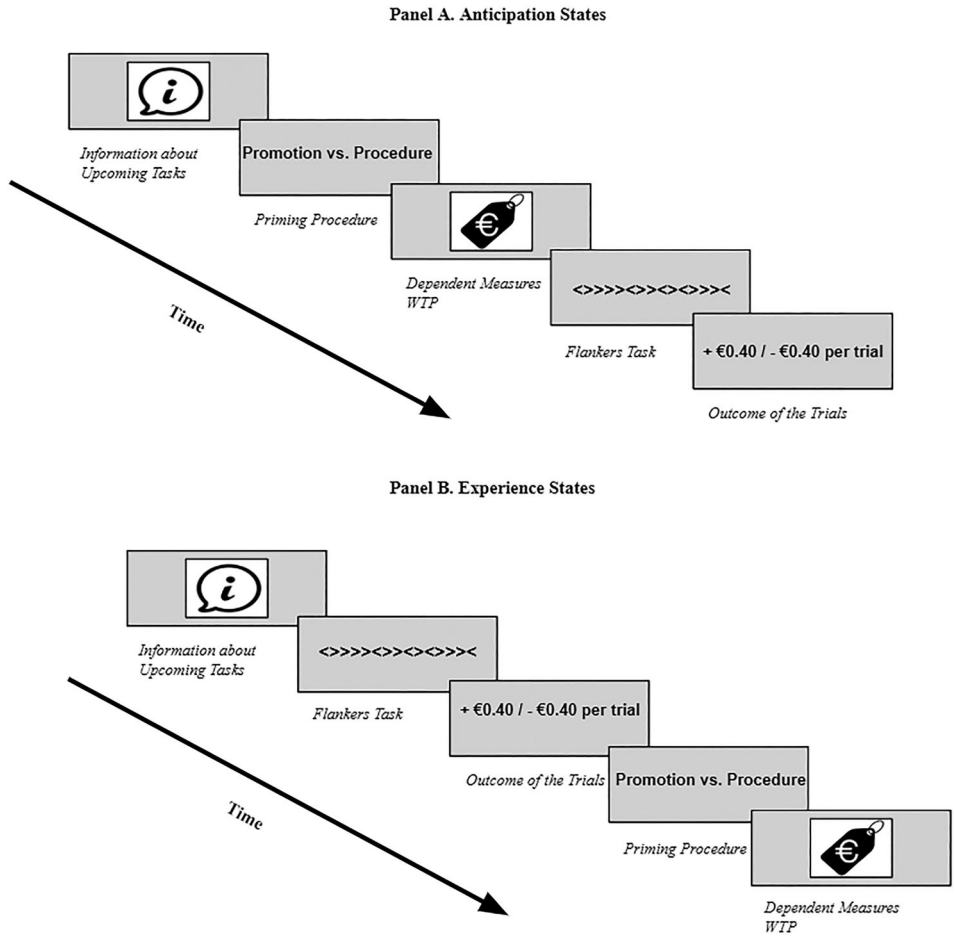

Figure 3. Order of tasks conducted in Experiment 2 for anticipation states (Panel A) and experience states (Panel B).

Dependent measure

Afterwards, participants were asked to indicate their willingness-to-pay (in Euro) for several daily-used, unbranded products – a loaf of bread, orange juice (1 L), bananas (1 kg), an apple pie, etc. (Ariely et al., 2003; Festjens et al., 2014; see Table 3 for the summary of means and standard deviations per condition). All willingness-to-pay values were subsequently summed up. The order of products for which the willingness-to-pay was requested was randomised. Funnelled debriefing indicated that none of the participants indicated awareness of any connection between the memory task and the willingness-to-pay questions.

To corroborate the cover story, we concluded this task with a short memory test, during which participants were asked to list words that had previously been flashed on the screen.

Table 3. Summary of Means and Standard Deviations per condition in Experiment 2.

		Motivational State	
Location of the Prime	Earning Potential	*Anticipation M*	*Experience M*
Central	*Gain*	2.03 (0.71)	2.28 (1.47)
	Loss	2.25 (0.88)	1.95 (0.62)
Peripheral	*Gain*	2.14 (0.74)	2.11 (0.76)
	Loss	2.17 (0.74)	2.20 (0.73)

Results

We excluded one participant who indicated outlying WTP measures (±3SD from the sample mean; Mischkowski et al., 2018; Park et al., 2015) across multiple products. To test whether primes are especially effective when they are delivered in accordance with the currently maintained attentional scope, we

conducted a 2 (motivational state: anticipation vs. experience) × 2 (monetary outcome: gains vs. losses) × 2 (location of the prime: central vs. peripheral) analysis of variance on the aggregated willingness-to-pay measure collected for the four unbranded products.[1]

In accordance with our expectations, a three-way interaction between anticipation versus experience states, gains versus losses and the location of the primes (central vs. peripheral) reached statistical significance ($F(1, 558) = 5.10$, $p = .02$, $\eta^2 = .01$). No other effects were statistically significant. We further probed the interaction to investigate which simple two-way interaction within the above-mentioned three-way interaction was significant depending on the location of the primes. In line with our expectations, a simple two-way interaction between motivational state and monetary outcome turned out to be significant for the centrally delivered primes ($F(1, 564) = 7.28$, $p = .01$), while the same two-way interaction failed to reach significance for primes that were delivered peripherally ($F(1, 564) = 0.07$, $p = .79$).

We further decomposed the three-way interaction to conduct a simple main effects analysis to achieve a more comprehensive understanding of the identified three-way interaction. This analysis corroborated the findings that the presented pattern of the three-way interaction resulted from responsiveness to central rather than peripheral primes. When participants were exposed to primes in the central scope of their vision, they indicated lower willingness when gains were still anticipated ($M = 2.03$, $SD = 0.71$) in contrast to gain experience states ($M = 2.28$, $SD = 1.47$; $F(1, 558) = 2.94$, $p = .09$), indicating higher responsiveness to thrift-related primes in the gain anticipation states. In contrast, for losses the effect of centrally presented primes reversed with participants being more susceptible to the effects of such primes in the loss experience ($M = 1.95$, SD = 0.62) rather than in the loss anticipation state ($M = 2.25$, $SD = 0.88$; $F(1, 558) = 4.38$, $p = .04$). Conversely, for peripherally delivered primes the motivational state did not affect WTP for presented products neither for monetary gains ($M_{anticipation} = 2.14$, $SD = 0.74$; $M_{experience} = 2.11$, $SD = 0.76$; $F < 1$), nor for monetary losses ($M_{anticipation} = 2.17$, $SD = 0.74$; $M_{experience} = 2.20$, $SD = 0.73$; $F < 1$).

Interestingly, the pattern of the interaction between motivational state (anticipation vs. experience) and monetary outcome (gains vs. losses) conceptually replicated the disordinal interaction presented in Experiment 1. Participants became responsive to centrally presented thrift primes particularly under the conditions of high motivational intensity, thus in gain anticipation or loss experience states, when attentional scope was shown to narrow (see Figure 2). In these conditions, participants were more likely to respond in line with the implications of the thrift prime (see Figures 4 and 5).

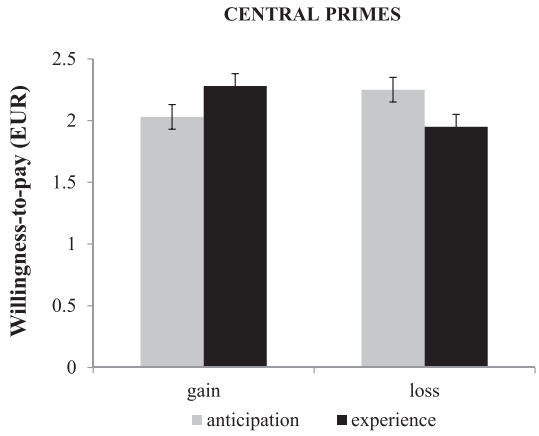

Figure 4. Willingness-to-pay measures indicated after exposure to centrally located primes. Error bars denote one standard error around the mean.

General discussion

By means of two lab experiments, we confirmed our notions regarding the influence of monetary gains versus losses on attentional scope and the influence of attentional tuning on consecutive goal pursuit. We demonstrated a disordinal interaction between monetary gains versus losses and anticipation versus

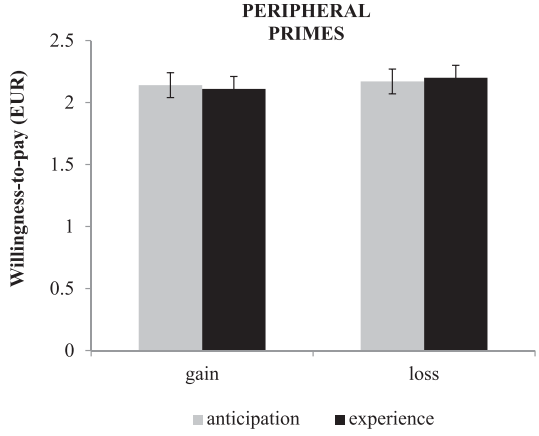

Figure 5. Willingness-to-pay measures indicated after exposure to peripherally located primes. Error bars denote one standard error around the mean.

experience states. Replicating previous research (Gable & Harmon-Jones, 2010a, 2011), we corroborated the findings that attentional scope narrows when monetary gains are anticipated, whereas it broadens with the experience of monetary gains. We showed that the experience rather than the anticipation of losses, results in a narrowing of attentional scope. Subsequently, attentional scope further determines which priming procedures are effective and which are inconsequential for judgment and decision-making. We found that centrally presented goal-relevant primes particularly affect people when they are shown under conditions of narrow attentional scope – when gains are anticipated or when losses have been experienced.

Our findings support the recent stream in the literature that concentrates on the qualitative difference between anticipation and experience of losses (Andrade et al., 2009, 2014; Boyce et al., 2013). Despite the fact that loss aversion has been shown to be an information processing bias that falls under the umbrella term of affective forecasting errors (Kermer et al., 2006), our findings support the alternative account that presents loss aversion as a phenomenon that occurs also in the experience state. More specifically, we demonstrate that immediate cognitive reaction to loss experience – narrowing of attentional scope – occurs when losses have been experienced, but not when they are merely anticipated. The literature on affective forecasting errors often incorporates longer temporal perspectives on loss experience, taking into consideration people's lack of awareness of cognitive mechanisms (rationalisations, Gilbert et al., 1998), attenuating the detrimental impact of negative affective states over a longer time frame. Such mechanisms are part of the psychological immune system (Gilbert et al., 1998), operating frequently without conscious awareness. Nonetheless, research also shows that, for instance, experienced losses in income significantly diminish subjective well-being (Boyce et al., 2013). These findings challenge straightforward expectations that could be derived for attentional processes from research on impact bias (Wilson et al., 2000) and dovetail nicely with Loewenstain's hot-cold empathy gap (1996); the work on overoptimism and wishful thinking (Krizan et al., 2009); and research on human behaviour in the gambling context (Andrade et al., 2009). Thus, we demonstrate that despite the fact that people tend to anticipate that losses are difficult to cope with, sometimes they significantly mispredict their instant emotional and subsequent cognitive reactions. In this research, we specifically examined what happens to instant cognitive reactions – how attentional scope is shaped by the anticipation and experience of both gains and losses. The immediate narrowing of attentional scope could be discerned as a functional psychological mechanism, aimed at circumventing any potential future losses, which, on the basis of experience, are seen as hurtful and consequently undesirable.

Additionally, our research contributes to the discussion regarding the processes that guide the attentional tuning phenomenon. At first, our results could be seen as contradicting Levine and Edelstein's theories (2009). Levine et al. (2009) classified emotions into two major categories: (1) pre-goal emotions (e.g. desire or anger), reflecting the appraisal that goal-directed actions will need to be taken in the near future; and (2) post-goal emotions (e.g. happiness or sadness), indicating that successful goal attainment or goal failure has already occurred. Building on this framework, follow-up research showed that pre-goal emotions induce attentional narrowing, whereas post-goal emotions evoke the broadening of attention (Kaplan et al., 2012). In line with this research stream, we could expect that pre-goal negative states (e.g. loss anticipation states) will consequently lead to attentional narrowing, whereas post-goal negative states (loss experience states) will elicit broadening of attentional scope.

Nonetheless, the literature to date lacks an obvious consensus with regard to the impact of negative affective states on attentional scope. An alternative account proposes that negative states could result in hypervigilance (Quenette, 1990) inducing broadening rather than narrowing of attentional scope (Eysenck et al., 1992; Rossi et al., 2013; Shackman et al., 2011; Somerville et al., 2010; Weymar et al., 2014). Our findings demonstrating broadening of attentional scope in the loss anticipation state align with the research showing that negative states induce hypervigilance resulting in greater environmental scanning and broad attentional scope prior to the detection of a potential source of this particular negative state (Eysenck et al., 1992). What is even more interesting is that hypervigilance was observed in previous research particularly for negative affective states characterised by uncertainty, such as threat (Weymar et al., 2014) or anxiety (Shackman et al., 2011). People in the loss anticipation states are also highly uncertain about the outcomes of their impending

goal pursuit – after hearing that potential losses might happen in the near future they have no possibility of estimating the likelihood of such an event to happen. In contrast, upon loss experience people can verify their beliefs with reality while comparing their expectations regarding experiencing losses with the actual experience of losses. The narrowing of attentional scope following the experience of losses is an instance of a rapid cognitive reaction to an uneasy experience of monetary losses, upon the realisation of the intensity and severity of such negatively-valenced "hot states" (Loewenstein & Loewenstein, 1996). While diverting from direct expectations that could be derived from previous research (Levine et al., 2009), we demonstrate that our perception of the attentional tuning process should not be plainly one-dimensional. Losses should be considered as unique experiences that attune the attentional scope in their own distinctive way.

Interestingly, our findings relating to both anticipation and experience of losses nicely dovetail with the defence cascade models that clarify the defensive behaviour of animals (Fanselow & Fanselow, 1994; Lang et al., 1997, 2000). These models demonstrate that when signals of threats in the environment are present but no specific source of threat has yet been detected, the pre-encounter, threat-unspecific hypervigilance occurs – the attentional scope broadens so that an organism can process a wider scope of information and identify the exact source of threat. As soon as the threat is detected, the post-encounter stage follows, characterised by active defensive behaviour mainly concentrated on the fight or flight response (Keil et al., 2010). Overlapping findings with regard to attentional processes and defence mechanisms in humans were presented by Weymar et al. (2014) who showed both pre-encounter and post-encounter hypervigilance in spider-phobic individuals. Furthermore, Eysenck (1991), while investigating attentional processes in anxious people, also observed first the stage of general hypervigilance through broad environmental scanning which subsequently transformed into enhanced selective attention. Such attentional cascade – broad attentional scope followed by narrowed attentional scope – maps onto our results for losses. In the loss anticipation states, when losses are uncertain, broad attentional scope helps people prevent uncertain losses from happening. Conversely, narrower attentional scope after losses have been experienced results from both the severity of such experience and the realisation that a more active behavioural response, either in the form of fight or flight, with a greater focus on details might be more beneficial in the future.

Our results are additionally compatible with Wachtel and Wachtel's (1967) curvilinear (inverted U-shape) relationship between attention and performance, since our findings show both the adaptive value of excluding irrelevant cues in the peripheral field of vision for participants in the loss experience condition, but also the reverse. That is, the inverted U-shaped relationship implies that performance will first improve because irrelevant cues are shut out but may subsequently deteriorate as goal-relevant cues also become ignored. We observe the latter phenomenon in the loss anticipation condition where target words were presented peripherally and, indeed, proved not to influence subsequent task performance (i.e. the WTP ratings). Thus, people tend to disregard goal-relevant primes if they appear beyond their currently maintained attentional scope, despite the fact that the primes can assist them in their subsequent goal pursuit.

The phenomenon of attentional tuning induced by either gains or losses also helps to qualify the priming effects introduced so far in the literature. Up to now, the extensive scope of experimental designs implemented in previous research delivered primes in the parafoveal (i.e. peripheral) scope of vision (Chartrand et al., 1999; Custers et al., 2007; Laran et al., 2011), especially during subliminal procedures, due to the fact that such stimuli are processed minimally and outside of conscious awareness (Nelson et al., 1980). Nonetheless, a narrow attentional scope triggers a tunnel vision effect, as a result of which people are unable to sufficiently attend to peripheral cues (Gable et al., 2011; Wadlinger et al., 2006). Therefore, people with an activated narrow attentional scope are unable to process peripheral priming procedures and, as a consequence, peripherally delivered primes are not effective. Hence, this attentional tuning phenomenon should be perceived as yet another factor moderating the effectiveness of priming procedures.

Note that in contrast to previous research that used goal-irrelevant peripheral primes (e.g. Chartrand et al., 1999; Custers et al., 2007; Laran et al., 2011), in our research we employed goal-relevant primes. Participants in our studies had a salient goal in mind, particularly when motivational intensity was high, i.e. in both gain anticipation and loss experience states. In these states, as a result of increased motivational intensity, attentional scope narrowed. Consequently, centrally

rather than peripherally delivered primes should be more impactful for ensuing judgment and decision-making in these states, particularly when they are goal-relevant, which was the case in the present study. Future research might profitably explore what types of primes would serve in this role, and where "goal relevance" ends and "irrelevance" begins. Moreover, future studies may focus on the types of primes that may be more impactful when attentional scope broadens, i.e. in gain attainment and loss anticipation states. Possibly, peripherally delivered primes that signal novel opportunities (gain attainment) or behavioural alternatives (loss anticipation) may be particularly interesting candidates here.

Furthermore, future research can take into consideration additional relevant factors that can play a role in the particular theatre of operations of gains and losses and attentional scope. Additional moderating variables that have the potential to shape the attentional scope in the anticipation and experience states of gains and losses could be: magnitude of monetary pay-offs (Estle et al., 2006); uncertainty tied to the monetary pay-offs (Weber & Weber, 1994); or supraliminal or subliminal exposure to reward or loss cues (Bijleveld et al., 2010).

Note

1. We excluded two products from our analysis that were characterised by the highest number of outlying observations (a black mug) or a stable pattern in data (a bottle of water). Including these products in the analysis does not change the pattern of results (three-way interaction reaches statistical significance; $F(1, 558) = 2.95$, $p = .05$, $\eta^2 = .01$).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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